

## **APPENDIX A: SUPPLEMENTAL RESOURCE INVENTORY AND ANALYSIS: PORT HEIDEN/STEPOVAK BAY AREA**

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### **A.1 INTRODUCTION**

This Supplemental Resource Inventory and analysis for the Port Heiden/Stepovak Bay area of the Aleutians East Borough has been prepared to summarize and update information for the geographic area within the Borough which was not addressed in the original boundary of the Aleutians East Coastal Resource Service Area (AECRSA). Wherever possible, existing information available in coastal program documents of the Aleutians East CRSA (now Aleutians East Borough) and Bristol Bay CRSA has been incorporated into this supplemental inventory and analysis by appropriate reference.

The original Aleutians East CRSA coastal management program is included in the following documents, with minor changes as directed by the Alaska Coastal Policy Council during program approval:

- o Volume I. - Aleutians East Coastal Resource Service Area Conceptually Approved Coastal Management Plan (July 1985)
- o Volume II. - Resource Inventory for the Aleutians East Coastal Resource Service Area (April 1984, 2nd printing June 1986)
- o Volume III. - An Analysis of Potential Development and Environmental Sensitivity in the Aleutians East CRSA (July 1985)

The Bristol Bay Coastal Resource Service Area (BBCRSA) adjoins the immediate eastern boundary of the original AECRSA. Pertinent documents which comprise the BBCRSA coastal management program include the following:

- o Bristol Bay (CRSA) Coastal Management Program - Volume 1: Resource Inventory (January 1984)
- o Bristol Bay (CRSA) Coastal Management Program - Volume 2: Management Plan (June, 1987)

Effective April 24, 1989, the Alaska Department of Community and Regional Affairs certified the incorporation of the Lake and Peninsula Borough as a home rule

borough. The jurisdictional boundaries of the new borough now encompass the area which was formerly the Bristol Bay CRSA. Until the Lake and Peninsula Borough develops its own local district coastal management program, the policies and implementation procedures of the Bristol Bay CRSA coastal plan will remain in effect.

The following chapters of this supplemental resource inventory and analysis follow the format, where appropriate, of the Volume II. resource inventory atlas of the Aleutians East CRSA. Updated resource distribution information is generally described in this text and illustrated on the following revised resource inventory maps:

- Map 1 - Fisheries and Shellfish Resources
- Map 2 - Commercial/Recreational Fishing and Use Areas
- Map 3 - Terrestrial and Marine Mammal Resources
- Map 4 - Eagles, Seabirds, Waterfowl, and Geese

In Chapter 4, a supplemental Coastal Boundary discussion describes changes to the original Aleutians East CRSA coastal boundary which incorporate the additions of the Akutan area (west extension) and the Port Heiden/Stepovak Bay area (east extension) into the Aleutians East Borough coastal program. The revised coastal boundary of the Borough is shown on Map 5.

## A.2 PHYSICAL DESCRIPTION

### A.2.1 Coastal Description and Coastal Habitats:

With the addition of the Port Heiden/Stepovak Bay areas to the Aleutians East Borough, the area encompassed by the Borough coastal management program extends east along the north coast of the Alaska Peninsula to Strogonof Point at the south entrance of Port Heiden, and east along the south coast of the Alaska Peninsula to include all of Stepovak Bay and the west half of the Kupreanof Peninsula (see Map 5).

The north Peninsula segment (Cape Seniavin to Port Heiden) is part of the Bristol Bay Lowlands physiographic province. Along the south side of the Peninsula, the additional area included in the Aleutians East Borough is part of the Aleutian Range physiographic province. Portions of both of these provinces were part of the original AECRSA coastal area; pertinent descriptions of the geography, climate, drainage, and sea ice conditions are available in Chapter 1 of the Volume II. AECRSA Resource Inventory Atlas and Part II of the BBCRSA Volume 1 Resource Inventory.

The coastal habitats of the Port Heiden/Stepovak Bay area include the following types:

#### Cape Seniavin to Port Heiden

- o Offshore Areas
- o Estuaries
- o Barrier Islands and Lagoons
- o Wetlands and Tidelands
- o Exposed High Energy Coast
- o Rivers, Lakes, and Streams
- o Important Uplands

Stepovak Bay/Kupreanof Peninsula

- o Offshore Areas
- o Estuaries
- o Barrier Islands and Lagoons
- o Wetlands and Tidelands
- o Rocky Islands and Seacliffs
- o Exposed High Energy Coast
- o Rivers, Lakes, and Streams
- o Important Uplands

A description of each coastal habitat type is provided in Chapter 1 of the AECRSA Resource Inventory Atlas (Volume II.), and Part II of the BBCRSA Resource Inventory (Volume 1). The occurrence of Alaska Coastal Management Program coastal habitats is shown on Map 6 of the BBCRSA Resource Inventory (Volume 1).

During October 1975 aerial surveys by the Alaska Department of Fish and Game, the coastal bird habitats of North Peninsula estuaries were characterized and delineated as part of the outer continental shelf study program. At Port Heiden and the Seal Islands, the shorelines are comprised of sandy beach, mud/sedge meadow ecotone, and mud/beach rye ecotone; the waterfowl habitats include sedge meadow, sand, beach rye, and mud flats. The total estuary area (including open water) at Port Heiden and the Seal Islands are 67,320 acres and 23,517 acres, respectively (Timm, 1977). The breakdown of shoreline types and habitats for these two important use areas for waterfowl and geese are presented in Tables 1 and 2.

The Port Heiden Critical Habitat Area, managed by the Habitat Division of the Alaska Department of Fish and Game, was established in 1972. It encompasses 72,128 acres, encompassing an extensive estuarine environment of tidelands and wetlands. In the spring and fall, large flocks of waterbirds, including thousands of ducks, geese, and shorebirds stop at Port Heiden to rest and feed before proceeding on their migration. A portion of the Port Heiden Critical Habitat Area, shown on Map 5 of this supplemental resource inventory, occurs within the Aleutians East Borough south of Stroganof Point (ADF&G, 1989).

Table 1: Shoreline Habitat components (miles)

<u>Area</u>	<u>Sandy Beach</u>	<u>Mud/Sedge Meadow Ecotone</u>	<u>Mud/Beach Rye Ecotone</u>	<u>Total</u>
Port Heiden	18.6	38.2	8.0	65.7
Seal Islands	19.3	36.4	21.0	76.6

Source: Timm 1977

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Table 2: Waterfowl Habitat Types (acres)

<u>Area</u>	<u>Sedge Meadow</u>	<u>Sand</u>	<u>Beach Rye</u>	<u>Mud Fiat</u>	<u>Total</u>
Port Heiden	19672	1478	2687	27432	51268
Seal Islands	9672	3416	2034	3832	19045

Source: Timm 1977

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#### A.2.2 Geology and Natural Hazards

The regional geology and natural hazards of the Port Heiden/Stepovak Bay areas are generally described and discussed in Chapter 2 of the AECRSA Resource Inventory Atlas (Volume II.), and Part II. and Map 5 of the BBCRSA Resource Inventory (Volume 1). Additional information is also available in Chapter 2 of the BBCRSA Management Plan (Volume 2).

A.2.3 Oil, Gas, and Minerals

The occurrence and potential for oil, gas, and mineral resources within the Port Heiden/Stepovak Bay areas is discussed in Part II. of the BBCRSA Resource Inventory (Volume 1) and Chapters 2 and 5 of the BBCRSA Management Plan (Volume 2). Chapter 3 of the AECRSA Resource Inventory (Volume II.) also describes oil and gas onshore and offshore basins, and mineral occurrence and mining activities on the Alaska Peninsula. The locations of oil, gas, and mineral resource development opportunities are depicted on Map 3 of the BBCRSA Management Plan (Volume 2).

The coastal area of the Bristol Bay lowlands southwest of port Heiden to upper Blueberry Creek and Seal Island has been ranked, on a state-wide basis, by the Department of Natural Resources as exhibiting moderate potential for discovery of oil and gas resources (USFWS, 1985). Along this oil and gas province of the North Peninsula coast, State of Alaska Oil and Gas Lease Sale #56 was removed from the 5-year schedule of the state's leasing program in 1989 (A. Crippen, personal communication, 1991). The Department of Natural Resources also ranked the oil and gas province in the Stepovak Bay area as having low potential for oil and gas resources (USFWS, 1985). There are currently no state uplands or tidelands in the Port Heiden/Stepovak Bay areas proposed or scheduled for oil and gas sales in the near future.

The topography of the coastal lowlands within the Aleutians East Borough between Port Heiden and Cape Seniavin does not provide characteristic mineral terrane. Limited geographic areas of potential mineral terrane are located on the west side of the Kupreanof Peninsula and in the foothills at the head of the Stepovak Bay lowlands (Chapter 5 of the BBCRSA Management Plan - Volume 2). Copper and molybdenum mineralization, often associated with gold, silver, lead, and zinc, has been explored in the Ivanof River area. A sublimation deposit of sulfur (direct deposit from the gaseous state) has been identified 7 1/2 miles north of Ramsey Bay, in Stepovak Bay, in a practically inaccessible area on a vertical slope. The sulfur deposit is estimated to be about 100 feet thick for a distance of one-third of a mile (USFWS, 1985). There has been no active exploration for minerals within the Port Heiden/Stepovak Bay areas of the Aleutians East Borough in recent years (M. Henning, personal communication, 1990).

### A.3 BIOLOGICAL DESCRIPTION

The Aleutians East CRSA Resource Inventory (Volume II.) provides a comprehensive overview of the distribution, habitat and use areas, and important life history features of biological resources within the Aleutians East Borough. Additional information is also provided in Part II. of the BBCRSA Resource Inventory (Volume 1).

#### A.3.1 Marine Fish

The distribution and life history discussions for marine fish and shellfish in offshore waters in the vicinity of the Port Heiden/Stepovak Bay area are described in Chapter 4 and shown on Map 4 of the AECRSA Resource Inventory atlas (Volume II.). Principal concentration areas, spawning grounds, and nursery areas for halibut and groundfish species generally occur offshore from Borough coastal waters.

Known areas of marine fish and shellfish presence in coastal waters are depicted on Map 1 of this supplemental resource inventory and include:

- o Herring (migration, spawning, rearing and feeding, and overwintering)
- o Razor Clams (concentration areas)
- o Shrimp (distribution)
- o Tanner Crab (distribution, molting/mating areas)
- o Dungeness Crab (distribution)
- o Red King Crab (distribution, rearing areas)

The Map 1 marine fish and shellfish resource distribution information updates data on Map 7 of the BBCRSA Resource Inventory (Volume 1).

#### A.3.2 Anadromous Fish

The location, species, and life history use (spawning, rearing) of Port Heiden/Stepovak Bay area streams by anadromous fish is depicted on Map 1 of this supplemental resource inventory. Map 1 updates anadromous fish stream location information shown on Map 7 of the BBCRSA Resource Inventory (Volume 1). Anadromous fish

species which occur in the streams in this portion of the Aleutians East Borough include chum salmon, coho salmon, king salmon, pink salmon, sockeye salmon, and steelhead trout. Pertinent descriptions of life history features for these species of anadromous fish are provided in Chapter 5 of the AECRSA Resource Inventory atlas (Volume II.).

A general overview of the status of salmon fisheries along the North and South Peninsula of the Port Heiden/Stepovak Bay areas of the Aleutians East Borough is presented below (ADF&G, 1985d).

Chum Salmon - On the South Peninsula, runs of chum salmon are found in every bay east of False Pass. Stepovak Bay is one of the areas for major commercial fisheries of local chum salmon stocks. There are no major chum fisheries in this area of the North Peninsula.

Coho Salmon - Little information is available concerning coho salmon stocks along the South Peninsula; runs are generally scattered and small. Coho salmon occur in the streams of Stepovak Bay. On the North Peninsula, Seal Islands (Ilnik Lagoon) and Port Heiden are principal locations for coho salmon commercial harvests.

King Salmon - Although some streams on the South Peninsula appear to be as suitable as North Peninsula king salmon producing streams, none are found on the south side of the Alaska Peninsula in this area of the Aleutians East Borough. Any king salmon harvested from South Peninsula waters are probably strays or are migrating to other areas. King salmon are found throughout the North Peninsula. Major spawning areas occur in the Meshik River system (Port Heiden) with smaller runs present as far west as Moffet Bay.

Pink Salmon - Pink salmon are the major species of salmon along the South Peninsula, and populations have greatly increased during the past 25 years. Major producing streams for pinks in the South Peninsula region are not present in the Stepovak Bay area.

Sockeye Salmon - Sockeye salmon runs along the South Peninsula are numerous but small. The West Stepovak sections is one of the few streams included in selected surveys for sockeye salmon. Along the North Peninsula, sockeye salmon are found in nearly every drainage. Although the major North Peninsula run occurs at Bear River, the Seal Islands (Ilnik Lagoon) support an important run of sockeyes.

The anadromous fish streams of the Port Heiden/Stepovak Bay areas support commercial fishery harvests, provide extensive feeding areas for brown bears, and produce salmon and steelhead for limited recreational sport fishing. A comparison of brown bear feeding areas along fish streams and the known distribution of anadromous fish streams suggests that there could be a number of currently undocumented anadromous fish streams in the region.

#### A.3.3 Marine Mammals

The occurrence and distribution of marine mammals in the Port Heiden/Stepovak Bay areas are depicted on Map 3 of this supplemental resource inventory; this information updates marine mammal distribution shown on Map 7 of the BBCRSA Resource Inventory (Volume 1). Discussions of important life history information for whales, sea otters, walrus, sea lions, and harbor seals are provided in Chapter 6 of the AECRSA Resource Inventory (Volume II.), and Part II. of the BBCRSA Resource Inventory (Volume 1).

Aerial surveys by researchers have indicated that gray whales present along the North Peninsula coastline during northward spring migration appear to remain close to shore. The nearshore coastal areas used by gray whales are shown on Map 7 of the BBCRSA Resource Inventory (Volume 1).

The only recognized sea lion haul-out concentration in the Stepovak Bay area is located at Kupreanof Point. Due to a precipitous decline in the state-wide population of sea lions, the National Marine Fisheries Service adopted an emergency regulation on April 5, 1990, that designated the sea lion as a "threatened" species under the Endangered Species Act. Commercial fishing operations could be restricted by the National Marine Fisheries Service if deemed necessary to protect sea lions, pursuant to the Endangered Species Act. The emergency regulation prohibits shooting at or near any sea lion in U.S. waters, except for native subsistence.

Known haul-out sites for walrus are present along the North Peninsula coast south of the mouth of the Bear River and at Cape Seniavin. The barrier islands, lagoons, and tideflats of the Seal Islands and Port Heiden provide haul-out concentration areas for harbor seals. Established sea otter populations are present along the North Peninsula southwest of Cape Seniavin, and in the bays and coastal waters of Stepovak Bay and outer Ivanof Bay. A concentration area for sea otters is present on the west side of Stepovak Bay south of Clark Bay.

#### A.3.4 Terrestrial Mammals

The distribution of brown bears and caribou in the Port Heiden/Stepovak Bay areas is shown on Map 3 of this supplemental resource inventory. Discussions of important life history information are provided in Chapter 7 of the AECRSA Resource Inventory (Volume II), and in Section II. of the BBCRSA Resource Inventory (Volume 1).

The caribou which occupy coastal habitats in this area are part of the North Peninsula herd which ranges between King Salmon and Port Moller. Caribou may be present in essentially all habitats except the higher elevation of Mount Veniaminof and the Aleutian Range. The lowlands along the north side of the Peninsula between Port Heiden and Port Moller provide critical calving areas for this herd, and major migration corridor crosses the drainages at the head of Port Heiden.

Seasonally, brown bears are known to concentrate in the spring in coastal lowlands along the north side of the Peninsula and along the barrier islands and tideflats of the Seal Islands to forage for newly-emerged grasses and beach carrion. As salmon enter coastal streams to spawn along both the North Peninsula and Stepovak Bay drainages, brown bears concentrate along the streams to take advantage of the abundant food supply. Intensive sport hunting areas for brown bear occur in the drainages of the Meshik River and its tributaries adjoining Port Heiden.

#### A.3.5 Birds

The distribution of bald eagles, seabird colonies, waterfowl, and geese in the Port Heiden/Stepovak Bay areas is shown on Map 4 of this supplemental resource inventory; this information updates the bird resource data shown on Map 7 of the BBCRSA Resource Inventory (Volume 1). A discussion of important life history information for birds is available in Chapter 8 of the AECRSA Resource Inventory atlas (Volume II.), and Section II. of the BBCRSA Resource Inventory (Volume 1).

Seabird colonies along the North Peninsula are located on the Seal Islands (glaucous-winged gulls) and at Cape Seniavin (cormorants, black-legged kittiwakes, and common murre). Principal seabird colonies in the Stepovak Bay area are located at Bluff Point (cormorants and tufted puffins) and Kupreanof Point (glaucous-winged gulls, black-legged kittiwakes, horned puffins, and tufted puffins) (Sowls et. al, 1978).

Important habitats for waterfowl and geese are located along the North Peninsula in the tideflats and adjoining wetlands of Port Heiden and the barrier islands, tideflats, and wetlands of the Seal Islands (see habitat discussion in Chapter 1). Waterfowl use of these areas includes spring and fall concentration areas for migration resting and feeding, and molting areas. The importance of the north side of the Alaska Peninsula as a fall, and to a lesser degree spring, staging and resting area for waterfowl cannot be over emphasized. Port Heiden and the Seal Islands (also known as Ilnik Lagoon) are part of a continuum of estuary habitats for waterfowl extending from Egegik Bay to Izembek Lagoon. During spring and fall migration across the North Peninsula, scoters and emperor geese are common on all of the estuaries; dabbling ducks, tundra swans, snow geese, cackling Canada geese, and most species of shorebirds are more abundant in the estuaries from Seal Islands north (Ilnik Lagoon and Port Heiden included) (Timm, 1977).

Port Heiden and the wetlands of the Meshik River drainage are frequently used by emperor geese, black brant, and Canada geese as spring and fall migration and staging habitats. The wetlands and tideflats of the Seal Islands are used primarily by emperor geese for these same purposes.

Inter-tidal areas with broad mud flats and sedge-grass flats that flood at high tides are, taken as a whole, essential to the survival of many waterfowl, shorebirds, and indirectly to many seabirds in the region. A reasonable generalization is that the bigger such inter-tidal zones are, the greater their importance. A major reason for the importance of inter-tidal flats is the quantity of food available to waterbirds and geese (Timm, 1977).

Another critical function which inter-tidal areas fulfill is that they provide places for waterbirds and geese to use during spring and fall migration, before and after inland nesting areas are ice and snow free. Because the nesting season in Alaska is short, it is imperative that waterfowl arrive on the breeding grounds ready to nest as soon as conditions allow. If these critical inter-tidal areas were not available, waterfowl, shorebirds, and geese would have to overfly from their wintering grounds to the nesting areas. During the fall, inter-tidal areas serve as a safe resting and, in some cases, critical feeding area for the birds to gain strength and body fat for long migrations south. Port Heiden and the Seal Islands (Ilnik Lagoon) are two of the eight estuary areas along the North Peninsula which are critical to the survival of large numbers of waterfowl, shorebirds, and geese (Timm, 1977).

## A.4 COMMERCIAL FISHERIES

The coastal waters of the Port Heiden/Stepovak Bay areas are used for commercial fishing activities for salmon (chum, coho, king, pink, and sockeye), herring (food/bait and sac roe), tanner crab, red king crab, and dungeness crab. There are currently no commercial fisheries for shrimp in this area of the Aleutians East Borough. The commercial fishery management districts and locations of fishery activity are depicted on Map 2 of this supplemental resource inventory.

### A.4.1 Salmon

The South Peninsula commercial fishery for salmon is managed primarily for pink and chum salmon and, during June, for sockeye salmon intercept fisheries (harvest of fish bound for another destination). On the North Peninsula, commercial salmon fishery emphasis focuses on coho, sockeye, king, and chum salmon (ADF&G, 1985d).

Commercial fishery activity in coastal waters south of Cape Seniavin uses purse seine and drift gill net gear to harvest chum, king, and sockeye salmon. Between Cape Seniavin and Strogonof Point, drift gill net gear is used for sockeye salmon, with some use of set net gear in the vicinity of the central Seal Islands. In Port Heiden near Strogonof Point, set net gear is used to harvest chum, king, coho, and sockeye salmon. Drift gill net and set net gear is used in the eastern half of Port Heiden to harvest the same species of salmon.

Salmon fisheries in nearshore waters and embayments of Stepovak Bay harvest pink, chum, and sockeye salmon with purse seine and set net gear. Purse seine fisheries in waters on the east side of the Kupreanof Peninsula target pink, chum, coho, and sockeye salmon.

### A.4.2 Herring

There are no commercial fisheries for herring along the North Peninsula coast. Herring fisheries in Stepovak Bay include sac roe harvest in nearshore embayments and Ivanof Bay, and food/bait harvest of herring throughout the area.

A.4.3 Halibut and Groundfish

There are no commercial groundfish or halibut harvests in nearshore waters of the Port Heiden/Stepovak portions of the Aleutians East Borough.

A.4.4 Shellfish

Dungeness crab and red king crab are harvested with pot gear in Stepovak Bay and Ivanof Bay. Pot gear harvest of tanner crab occurs in outer Stepovak Bay and outer Ivanof Bay. Prior to 1982, shrimp were harvested in Stepovak Bay.

## **A.5 SOCIO/CULTURAL DESCRIPTION**

### **A.5.1 Historical and Archaeological Resources**

Chapter 15 of the AECRSA Resource Inventory (Volume LL.), and Part I of the BBCRSA Resource Inventory (Volume 1 ) provide a discussion of cultural resources within the Port Heiden/Stepovak Bay areas of the Aleutians East Borough. Historical and archaeological resources in this area are documented by the State Historic Preservation Office of the Department of Natural Resources. The locations of cultural and historic resource sites are not identified in this supplemental resource inventory to avoid development of a "treasure map" which could lead to unauthorized disturbance of these important areas. For information concerning cultural resource sites, contact the State Historic Preservation Office or the Coastal Coordinator, Aleutians East Borough.

### **A.5.2 Land Ownership and Management**

A description of the land ownership patterns of the Port Heiden/Stepovak Bay areas is available in Part I and Map 4 of the BBCRSA Resource Inventory (Volume 1), in Chapter 17 and Map L of the AECRSA Resource Inventory atlas (Volume LL.), and in the Aleutians East Borough Municipal Lands Entitlement Study. North Peninsula lands within the Borough are comprised of State lands and the Port Heiden Critical Habitat Area (Map 5 of this supplemental resource inventory). Adjoining Stepovak Bay, lands are owned or managed by native corporations or included within the federal national wildlife refuge system. The state lands of the North Peninsula are encompassed in Management Units 21 and 22 of the Bristol Bay Area Plan (ADNR, 1984).

### **A.5.3 Recreation, Sport Hunting and Fishing**

A discussion of recreation and sport hunting and fishing activities in the Port Heiden/Stepovak Bay area is available in Part 1 of the BBCRSA Resource Inventory. The locations of important sport fishing areas (and principal fish species of interest) along anadromous fish streams is depicted on Map 2 of this supplemental resource inventory. Intensive sport hunting areas for brown bear (Map 3) and waterfowl/geese (Map 4) are also included in this supplemental inventory.

Although access to recreational sport fishing and hunting areas in this area of the Aleutians East Borough is limited to aircraft and boat transportation, the Department of Natural Resources has issued or considered several requests for lease of state lands for operation of commercial recreational sites along the North Peninsula area (personal communication, W. Dolezal, 1991). Interest has been expressed by several applicants to establish a commercial lodge and guiding operation at Blueberry Creek on the northeast corner of Seal Islands Lagoon. Similar developments have been proposed on Fracture Creek west of Wildman Lake, and along the upper Sandy River in the Lake and Peninsula Borough.

#### A.5.4 Subsistence and Personal Use

A discussion of subsistence and personal uses of fish and wildlife resources in this area may be found in Part 1 of the BBCRSA Resource Inventory, and in Volume II. of the Alaska Habitat Management Guide, Southwest Region: Human Use of Fish and Wildlife. This later document shows use of portions of this area by residents of Manokotak, Togiak, Twin Hills, Aleknigik, Clarks Point, Dillingham, Port Heiden, Pilot Point, and Chignik Lake and Chignik Lagoon for subsistence purposes. Proposed uses and activities within the coastal portion of this area should refer to both these documents for information on potential affects on subsistence and personal use.

## A.6 SUPPLEMENTAL RESOURCE ANALYSIS

A comprehensive discussion of resource analysis concerns is provided in the AECRSA Analysis of Potential Development and Environmental sensitivity (Volume III.). The following sections provide updated information to supplement knowledge of potential development activities in the coastal area, or concerns related to environmental effects of development activities.

### A.6.1 Oil and Gas Development Potential

Although the North Peninsula lowlands and coastal area have the highest potential for oil and gas discovery, the Department of Natural Resources, Division of Oil and Gas, has removed state uplands (Sale # 56) and tidelands in this area from consideration under the state's 5-year leasing program. Oil and gas exploration in tidelands or onshore areas of the Aleutians East Borough is, therefore, highly unlikely in the near future. Exploration for oil and gas in the offshore areas of Bristol Bay (federal sale 92) is a highly sensitive issue due to the potential impact on the world class salmon commercial fishery of the area.

The Department of Natural Resources Bristol Bay Area Plan (ADNR, 1984) addresses management of state lands in the Port Heiden area and along the North Peninsula in Management Units 21 and 22. A potential trans-peninsula corridor for future oil and gas development has been identified along the east side of Port Heiden, following the Meshik River drainage and crossing the mountains to the Pacific Ocean side of the Peninsula. This corridor is outside of the Aleutians East Borough.

### A.6.2 Disposal of Seafood Processing Wastes

On a statewide basis, approximately 30-80% of the raw seafood harvest is discarded as waste during processing. For bottomfish species which average about 60% waste, this amounted to 3.2 billion pounds of discarded seafood processing wastes in the state in 1988. Onshore seafood processing facilities are currently present or have operated in the Aleutians East Borough at Port Moller, Sand Point, King Cove, Cold Bay, and Akutan.

Seafood processing wastes are introduced into coastal waters by both onshore and offshore (floating) seafood processing plants. In remote locations, seafood wastes comprised of unused fish and shellfish parts and processing water may receive no treatment prior to discharge. Current federal and state permits for disposal of seafood wastes under a General National Pollutant Discharge Elimination System (NPDES) authorization requires grinding of wastes to 0.5 inches, siting of outfalls such that wastes are dispersed and diluted, and compliance with state water quality standards.

The discharge of seafood processing wastes into marine waters which exhibit poor circulation or limited biological assimilation capacity can lead to water quality problems in the receiving waters. Impeded circulation may also lead to the accumulation of discharged processing wastes on the sea bottom. Seafood wastes impact the deep portions of the water column by exerting an oxygen demand as a result of decay. Research has shown that dissolved oxygen concentrations below the allowable state standard of 6.0 mg/l can occur near seafood processing waste accumulations on the sea bottom.

The principal pollutants of concern from the disposal of seafood processing wastes include total suspended solids (TSS), biochemical oxygen demand (BOD), and oil and grease. These pollutants come from the waste particles (shell, bone, skin, scales, meat, and dirt), blood, body fluids, slime, detergents, and fats from cooking and rendering operations. In addition, chlorine (disinfectant) may be present in residual amounts. Ammonia may also be present, but it is likely to be in negligible amounts. These pollutants can adversely impact the quality of the receiving water.

Aesthetic impacts from the discharge of seafood processing wastes can occur when these materials discolor the water or result in floating solids, scum, or foam. In addition to an obnoxious odor problem, shoreline accumulations of waste are unsanitary and can become rodent and scavenger attractants.

The extent of potential impacts caused by the marine discharge of seafood processing wastes is primarily determined by the amount of waste, the type of seafood being processed, the location of the discharge outfall, and the physical, chemical and biological characteristics of the receiving waters and sediments. When outfalls are submerged

below lower low water and are situated in locations with strong tidal currents where wastes can be dispersed, the impacts are minimized. If wastes accumulate because of restricted bottom circulation or the inability of the marine environment to cope with the rate of waste disposal, the accumulated deposits can smother benthic organisms and alter adjacent bottom communities. In extreme cases, sediments may become anoxic (depleted of oxygen).

A variety of organisms including birds, pelagic fish such as Dolly Varden and herring, and crabs are commonly attracted to the vicinity of seafood waste outfalls to feed on particles of fish and shellfish tissue.

Unused seafood wastes can be processed in reduction facilities to produce fish meal and fish oil. Seafood wastes are cooked, pressed, dried, and ground to produce meal. Oil is separated from the liquid waste water and the remaining liquid (called "stickwater") is evaporated. The thickened "stickwater" can be added to the meal. Some meal plants do not recover oil, and some discharge stickwater rather than recover the soluble proteins. A recent trend in Alaska is to pair meal plants with surimi production plants since a great percentage of the pollock is waste (approximately 75%) and meal generated from pollock is generally of high quality.

Sensitive Environments and populations - Coastal habitats with restricted water circulation (such as enclosed bays, lagoons, and some poorly flushed estuaries) are most sensitive to the impacts of seafood waste disposal. Sessile benthic organisms such as clams are particularly vulnerable to impact from accumulated deposits of seafood wastes.

Methods of Minimizing Impacts - Some effective methods for minimizing impacts from seafood waste disposal include:

- o Where possible, utilize 100 percent of seafood processing wastes in fish meal reduction plants.
- o Site waste discharge outfalls below lower low water (MLLW) in areas with strong tidal currents so that wastes are quickly dispersed and do not accumulate.
- o Locate discharge areas away from important benthic resources such as clam beds.

## ATTACHMENT 1 REFERENCES

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## ATTACHMENT 2 INDIVIDUALS AND AGENCIES CONTACTED

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Fairchild, L.	U.S. Fish & Wildlife Service Migratory Birds (786-3444)	Anchorage
Flensburg, S.	Bristol Bay Coastal Resource Service Area (842-2666)	Dillingham
Henning, M.	AK. Dept. Natural Resources Div. of Mining (762-2160)	Anchorage
Lockhart, D.	Aleutians West Coastal Resource Service Area (274-7555)	Anchorage
Mendenhall, V.	U.S. Fish & Wildlife Service Migratory Birds (786-3517)	Anchorage
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Smith, B.	National Marine Fisheries Service (271-5006)	Anchorage
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**APPENDIX B: SUPPLEMENTAL RESOURCE INVENTORY AND  
ANALYSIS: KRENITZIN ISLANDS AND AKUTAN AREA**

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**B.1 INTRODUCTION**

The Aleutians East Borough Coastal Management Program, an approved district program under the Alaska Coastal Management Program (ACMP), was initially developed as the Aleutians East Coastal Resource Area (CRSA) coastal plan. The boundary of the CRSA extended west to Unimak Pass, encompassing Unimak Island. The Alaska Coastal Policy Council approved the Aleutians East CRSA coastal management plan on October 30, 1985. The coastal plan policies were amended by the Division of Governmental Coordination and the Aleutians East CRSA on May 22, 1986, and July 7, 1987. Approval of the Aleutians East plan was received from the federal Office of Ocean and Coastal Resource Management (OCRM) on April 6, 1989.

During development of the Aleutians East coastal program, the City of Akutan proposed that the CRSA boundary be extended west to include the island of Akutan. On September 6, 1984, Akutan petitioned the Aleutians East CRSA to amend their boundary to encompass the islands west of Unimak Pass to Unalga Pass in the Aleutians East CRSA program (City of Akutan Resolution 84-05). The City of Akutan also requested that the Department of Community and Regional Affairs change the configuration of the Aleutians East CRSA to include Akutan Island (January 10, 1985). On November 19, 1986, the Commissioner of the Department of Community and Regional Affairs approved the expansion of the western boundary of the Aleutians East CRSA to Unalga Pass.

The Aleutians East Borough coastal district plan which the State of Alaska and OCRM approved addressed the original Aleutians East CRSA boundary which did not include the Krenitzin Islands in the Akutan area. Through this document, the Aleutians East Borough has initiated preparation of supplemental information for the Akutan area to address the program development requirements of the ACMP for a significant amendment to the Aleutians East Borough coastal management program.

This document provides supplemental Resource Inventory and Resource Analysis information applicable to the Krenitzin Islands and Akutan area. It is intended to supplement information, resource maps, and discussions in Volume II., Resource Inventory for the Aleutians East Coastal Resource Service Area (April 1984), and

**Aleutians East Borough Coastal Management Program**

Volume III, An Analysis of Potential Development and Environmental Sensitivity in the Aleutians East CRSA (July 1985). Except as provided by area-specific coastal resource information or analysis discussions, the original Resource Inventory and Resource Analysis documents for the Aleutians East coastal management program remain applicable to the Krenitzin Islands and Akutan area.

For ease of reference, the discussions of physical and biological features of the Akutan area generally follow the format and approach of the original Volume I and LL documents.

## B.2 PHYSICAL DESCRIPTION

### B.2.1 Coastal Description and Coastal Habitats

The Akutan area of the Aleutians East Borough coastal management program encompasses the Krenitzin Islands west of Unimak Pass to Unalga Pass. The area extends along approximately 60 miles of the eastern Aleutian Islands and includes the major islands of Ugamak, Tigalda, Avatanak, Rootok, Akun, Akutan, the Baby Islands, and Unalga Island (Map A). Detailed descriptions of the physical and topographic characteristics of most of the individual islands in the Attachment Area are provided in Nysewander et al. (1982) and USFWS (1988).

Akutan, the largest of the islands, is approximately 18 miles by 12 miles in size. The City of Akutan, located 800 air miles southwest of Anchorage, is the only community in the Attachment Area. The nearest communities are Unalaska, 35 miles to the west, and False Pass, 108 miles to the east.

#### Climate:

The islands encompassed in the area from Unimak Pass west to Akutan Pass are strongly affected by the influence of the maritime climatic zone. Compared to other areas of Alaska, this weather in this region exhibits relatively heavy precipitation, cool summers, and warm winters. Surface winds are also persistently strong in most areas. The Akutan area is situated just north of a major storm track and exhibits some of the highest storm frequencies for the state, particularly in mid to late winter and mid-summer.

The Bering Sea plays a key role in influencing the weather and climate of the region. Storms are associated with the Aleutian low pressure system and typically pass southwest - northeast across the Bering Sea. Cloudiness and fog are characteristic all year but predominate in summer. Within this region, mean maximum July temperatures are generally in the mid-50 degree F range, and mean minimum temperatures in January are in the high 20 degree F range. There are no records of temperature extremes at Akutan; however, the lowest recorded temperature at Dutch Harbor, 35 miles to the west, is 10 degrees F (Morrison-Knudsen, 1981).

The strongest winds occur in coastal areas along this portion of the Aleutian Island chain. Winter storms produce the strongest winds with average speeds in some areas of 17-21 knots. Summer storm intensities and frequencies are less, resulting in speeds of 9-13 knots. Extreme winds have been known to approach 100 knots. Periods of calm winds are short, averaging less than 5 percent of the time.

The marine waters which surround the islands of the Akutan area are an important facet of the Aleutians Islands ecosystem. The Alaska Stream is a permanent, strong westward flow south of the Aleutians. Waters of the northern Gulf of Alaska penetrate into the Bering Sea through major passes such as Unimak Pass and Akutan Pass. Unimak Pass averages 148 feet deep, and is described in greater detail in Volume 1 of the Aleutians East Borough coastal management program.

Local currents in the Aleutian Islands may be strong and unpredictable, setting counter to general trends in many places, including in the major passes. In narrow Akun Strait, currents of 12 knots have been reported. The effect of these currents is felt offshore at a considerable distance from the passes and often results in unexpected seas. In the Fox Islands passes, slack currents may change suddenly to flood tides of almost two knots in as little as 10 minutes.

Sea ice does not extend south from the Bering Sea into the area of the Akutan area. Conditions of sea state exhibit the greatest frequency of waves exceeding 12 feet during the fall. Sea waves of less than five feet occur most commonly during late fall and winter.

#### Coastal Habitats:

The relatively cool summers combine with terrain and climate to prevent the establishment of trees on the Aleutian Islands. The eastern Aleutians have plant communities similar to those found along the western Alaska Peninsula. These plant communities vary from a luxuriant tundra or heath vegetation (moist tundra) in lowlands to alpine tundra comprised of lichens, mosses, and low-growing alpine plants at higher elevations. High mountain ridges are generally barren, and valleys more than 3,000-4,000 feet in elevation may have perennial snow or relict glaciers, particularly in association with volcanic peaks. Where plant communities are present, their species composition is affected by topography, soils, and microclimate of the sites.

The factors of climate and growing conditions produce a limited spectrum of vegetative growth on islands of the eastern Aleutian chain. Akutan Island has alpine tundra and barren ground at higher elevations. On Akun Island, the northern portion is characterized as alpine tundra, while the southern portion is primarily moist tundra. The west end of Tigalda Island is moist tundra. Essentially all other upland habitats in the remainder of the Akutan Addition can be broadly characterized as alpine tundra.

Rivers and Streams:

The size and topography of the islands in the Akutan area control the character of the watercourses present in the region. Large streams do not occur due to the relatively limited drainage basins and steep slopes which produce short, swift, plunging streams, often with waterfalls at their marine water terminus. Streams with consistent year-round flow, access for fish at the coastline terminus, and usable aquatic habitat generally support spawning populations of anadromous fish. Documented anadromous fish streams in the Akutan addition area shown on Map B.

B.2.2 Geology and Natural Hazards

Geology:

The geology of most of the Aleutian Islands has been investigated only at a reconnaissance level because of remoteness, inaccessibility, extreme climatic conditions, limited resource potential, and low economic potential. The Aleutian Islands are composed almost entirely of Tertiary and Quaternary volcanic and volcanoclastic rocks. The older rocks date back to the Paleozoic and are both faulted and folded. The folding is open and dips are moderate. Major faults are reverse faults, and they parallel the island chain.

Various surficial deposits cover the eastern Aleutian Islands including volcanic ash, pumice, cinders, glacial till, outwash, and alluvium. These deposits were laid down by glacier ice, running water, lake water, mass wasting, and wind. Volcanic ash deposits mantle nearly all land surfaces except steep, rocky mountain masses on some islands. Where ash is present close to old volcanic cones, soils are gravelly. Erosion potential is generally moderate on soils of the mountain slopes and low on the coastal plain.

Volcanoes:

Akutan Volcano, located on western Akutan Island, is 4,265 feet in height and has had 23 eruptions since 1700. The date of the most recent eruption was during the fall of 1978 when ashfall caused some difficulties for seafood processors in the harbor in trying to keep processing equipment clean. Akutan Volcano is an explosive, andesitic volcano in which fumes and ash are present almost continuously. The diameter of the Akutan Volcano caldera is estimated at two kilometers (U.S. Geological Survey, 1950). Akutan's top has been replaced by a large caldera within which renewed activity is now building a second cone.

Seismic Activity:

The Akutan addition area is located in seismic risk zone 4, which indicates that the magnitude of the largest expected earthquake exceeds 6.0 on the Richter scale. Between 1947 and 1959, the Aleutians recorded 20 earthquakes with a magnitude of 7 or greater, and one event with a magnitude of 8. Earthquakes as high as magnitude 7 have been recorded within 20 miles of Akutan Island (Morrison-Knudsen, 1981).

Geothermal Resources:

The volcanic activity on Akutan Island is an indication of a geologic environment in which geothermal resources may occur. Several hot springs are located in Hot Springs Bay; they are thought to be fault-controlled discharge points for a potential hydrothermal system. Fumaroles are also reported on Akutan Volcano, and a tidal hot spring has been observed near the old whaling station in Akutan Harbor (Morrison-Knudsen, 1981).

Hot Springs Bay on the north side of Akutan Island has one of the primary hydrothermal systems identified in the Aleutians. The hot springs have a maximum discharge temperature of 180 degrees F, with an estimated maximum subsurface reservoir temperature of 350 degrees F. The soils at Hot Springs Bay are organic deposits of undetermined thickness. The low ridges which parallel the coast near the mouth of the valley appear to be composed of fine sand and silt.

Three hot springs have been identified in the valley at the head of Hot Springs Bay. The hot springs are located at the western margin of the valley floor; one in the intertidal area, another approximately one-third of a mile inland, and a third about 0.6 mile inland from the beach.

The intertidal spring areas consist of a beach seep at the salt water interface. The hottest discharge area reported for this location was through the creek channel, which was covered by one meter of beach sand at the time of examination (Morrison-Knudsen, 1981). Discharge from this spring was estimated at 2 gallons per minute over an area 50 feet in diameter. The temperature of the discharge was 130 degrees F.

The middle spring was comprised of three discharge points over an area of approximately 200 feet. The combined flow from the three discharge points was estimated at 20 gallons per minute and had discharge temperatures up to 140 degrees F.

The upstream spring also had three discharge points, the largest of which flowed at five gallons per minute with temperatures up to 180 degrees F. The remaining two discharge points had smaller flows and considerably cooler temperatures.

Collectively, the Hot Spring Valley system can be described as a shallow sedimentary system within the valley floor sediments capable of an estimated yield of 2.5 to 8 gallons per second with an estimated production temperature of 350 degrees F. Although it appears that an intermediate-depth hydrothermal system underlies the Hot Springs Bay valley, available geologic data is too limited to evaluate this potential (Morrison-Knudsen, 1981).

The potential geothermal system located in the Akutan Harbor at the location of the old whaling station is an intertidal spring visible at low tide. The system appears to be a fault-controlled discharge point and an intermediate-depth hydrothermal system, similar to the reservoir at Hot Springs Bay. It is assumed to be capable of a production temperature of 300-350 degrees F. The shallow fault system may produce a fluid consisting of a fresh water/sea water mix.

Morrison-Knudsen (1981 ) investigated the potential and preliminary feasibility of developing geothermal resources on Akutan Island. Potential uses for geothermal-generated power included salmon fishery enhancement (hatcheries), electric power generation for residential and industrial needs, and use of geothermal energy for space heating systems. Their analysis concluded that more exploration would be required to evaluate the geothermal resource potential and determine the feasibility of any development project. Key factors considered were the comparative costs of hydropower or diesel-generated electric power, industrial and population growth in Akutan, and the unpredictable future costs of petroleum fuels.

### B.2.3 Oil, Gas, and Minerals

#### Oil and Gas:

( ) The Akutan area is situated near the confluence of four Outer Continental Shelf Oil and Gas Planning Areas: Shumagin, Aleutian Arc, St. George Basin, and North Aleutian Basin. The Bureau of Land Management has rated the geologic potential for hydrocarbons as none for all parcels in the Alaska Maritime National Wildlife Refuge (USFWS, 1988), an area which comprises a major portion of the lands in the Akutan area.

Offshore oil and gas exploration has occurred in the St. George Basin north of the Krenitzin Islands, but the results did not appear promising. Based on the volcanic structure of the eastern Aleutian Islands and the apparent lack of appropriate sedimentary deposits in the immediate area of the Akutan area, there is probably low potential for discovery of oil and gas in the immediate area (Cass Arie, ADNR, personal communication, 1987).

The Minerals Management Service (MMS) has posed several oil transportation scenarios for transport of petroleum from the Bering Sea through Akun Strait and/or Unimak Pass in the event oil is discovered. MMS consideration of future oil and gas leasing and exploration in the St. George Basin generated a development scenario which could affect a portion of the Akutan area.

Within the St. George Basin, there is only a 2 percent chance that commercial quantities of hydrocarbons would be discovered. Any oil produced in the northern

subunit of the St. George Basin would be loaded offshore onto tankers and shipped through Unimak Pass. The oil industry has expressed interest in an additional shipping and storage shore-based facilities in the eastern Aleutians. While Dutch Harbor is the presumed first choice, an alternative could include pipelines run ashore to Akun Bay and piped to one of three potential terminal sites on the southwest side of Akun Island (USFWS, 1988). To date, oil exploration in the St. George Basin has been discouraging and likelihood of the oil trans-shipment facilities on Akun Island is very small. Ten exploration wells have been drilled and abandoned, no discoveries announced, and no further drilling is imminent. Ninety of 96 leases in the St. George Basin have been relinquished.

Minerals:

Except for historic mining of sulfur from a deposit on Akun Island near the turn of the century, little information is available concerning the occurrence or potential for occurrence of minerals. Mineral exploration has been impeded by the remoteness and inaccessibility of much of the land area. However, development of a commercially viable mineral deposit could potentially be enhanced by the proximity of tidewater to all areas of the Aleutian Island. Although new mineral exploration would not be permitted on U.S. Fish and Wildlife Service refuge lands, exploration and development could occur on lands where the Aleut Corporation manages subsurface rights.

### **B.3 BIOLOGICAL DESCRIPTION OF THE AKUTAN AREA**

#### **B.3.1 Marine Fish**

Productive offshore marine waters surrounding the Krenitzin Islands provide habitat for a wide variety of marine fishes including halibut, Pacific Ocean perch, Pacific cod, sablefish, yellowfin sole, salmon (pink, chum, coho, sockeye), walleye pollock, sandlance, and Pacific herring. Pacific herring are reported to spawn on the coastal beaches of Akutan Island. Shellfish available in the offshore waters include Tanner crab and king crab.

These marine fish and shellfish support an important and expanding commercial fishery and seafood processing industry. Some species such as sandlance and pollock also are extremely important forage foods for colonies of seabirds and marine mammals. The distribution of herring and shellfish in the Akutan area is shown on Map B. The location of groundfish and halibut fishing grounds in the vicinity of the Akutan area is depicted on Map E. Descriptions of the life history characteristics of marine fish and shellfish are provided in Volume LL., Resource Inventory for the Aleutians East CRSA (1984).

#### **B.3.2 Anadromous and Freshwater Fish**

Due to the remoteness of the region, little information is available concerning the distribution and abundance of anadromous fish resources in the Krenitzin Islands area (Map B). Pink and coho salmon occur in streams at the head of Akutan Harbor, and coho salmon are reported at Hot Springs Bay (Akutan), Surf Bay (Akun), and in one stream on Avatanak Island. Sockeye salmon, associated with lake rearing systems, occur on Akutan Island (Open Bight), Akun Island (Akun Bay), and Avatanak Island. Descriptions of the life history characteristics of anadromous fish are provided in Volume 11, Resource Inventory for the Aleutians East CRSA (1984).

#### **B.3.3 Marine Mammals**

Marine mammals are an important component of the wildlife resources of the region. Numerous suitable habitats for breeding, feeding, and haul-out are available along the coastline and relatively disturbance-free islands, particularly the smaller islands west of Unimak Pass. Marine mammals which occur in the Krenitzin Islands area include sea otters, fur and harbor seals, sea lions, whales, and porpoises. The known

distribution of marine mammals and important rookery and haul-out use areas are shown on Map C.

Very little is known about whales and porpoises that occur in the waters off the eastern Aleutian Islands. Gray whales migrate through Unimak Pass and Akutan Pass in their movements between the Pacific Ocean and Bering Sea. Blue and sei whales are found in waters from Akutan Island west to the end of the Aleutians. Sperm whales, killer whales, northern harbor porpoises, Dall porpoises, Baird's beaked whales, goosebeaked whales, Pacific beaked whales, minke whales, fin whales, humpbacked whales, and right whales are also found in water of the Aleutian Chain. Little information is available concerning their distribution and abundance. The killer whale, Dall porpoise, and minke whale are the three species most commonly observed (USFWS, 1988).

#### Northern Sea Lion:

Recent recognition of the severely depleted population status of the northern sea lion has created a special protection and management status for this marine mammal.

Sea lions do not migrate, but disperse widely after breeding and may occur near ice or on northern islands in the Bering Sea during fall and winter. Adult breeding animals and some subadults occupy rookeries during the breeding season from late May to early July; non-breeding sea lions use haul-out sites during the same period (Loughlin, no date). Two types of onshore use areas for sea lions are recognized - rookeries and haul-outs. Rookeries are areas where adult males actively defend territories and most females mate and give birth. Haul-outs are sites where few pups are present and where little breeding occurs.

Of approximately 38 known breeding rookeries for sea lions in Alaska, 24 are located in the Aleutian Islands. The shores of the volcanic islands provide a major portion of the breeding and hauling-out habitat for this species. The locations of known rookeries and haul-out sites for sea lions in the Krenitzin Islands are shown on Map C.

During 1974-80, the Alaska population of sea lions was estimated at 196,000 animals. Since that time, the population has declined significantly throughout Alaska, with the greatest decline (79%) noted in the eastern Aleutian Islands. Intensive survey efforts to

monitor changes in sea lion populations have been conducted at Ugamak Island. This island situated in the eastern portion of the Attachment area, is a major rookery in the eastern Aleutians which supported the largest aggregation of breeding sea lions in the entire Aleutian Island chain as late as 1969 (Merrick et al., 1987; Byrd and Nysewander, 1988).

Ugamak Island was a site for field studies by biologists during sea lion breeding seasons in 1969, 1977, 1978, 1985, and 1986. Other important sea lion use locations which received study are located on Akun and Akutan Islands. Daily counts were conducted on Ugamak Island to determine number of breeding males, number of females, and pup production; the study also made comparisons of survey counts conducted on land and those made from boats offshore. It was recognized that counts of sea lions are only indices of population because they exclude animals at sea, and it is difficult to tally numbers of animals at the exact time peak numbers are ashore.

Studies by Merrick et al. (1987) documented significant declines in the sea lion population in the eastern Aleutians (52,530 to 10,802 animals) between 1960 and 1985. They also showed a loss of 15,000 sea lions from the Ugamak and Akutan Island rookeries alone between 1968 and 1985. Pupping decreased 76% at Akutan Island between 1965 and 1985.

On Ugamak Island, the estimated number of sea lions was 14,536 in 1957 and 13,553 in 1968. Significant changes were not observed until 1975-78 by which time numbers had fallen to about 4,760 animals. Aerial surveys in 1984 and 1985 found 1,252 and 1,429 sea lions, respectively. On-the-ground counts of sea lions on Ugamak Island at comparable sites and survey dates showed a decline of 84% (10,295 to 1,684) between 1969 and 1986 (Merrick et al., 1987). Breeding animal presence did not decline equally at all Ugamak Island sites. Occupancy of rookeries first decreased on the south side of the island, then declined on the north side of the island until most north-side sites are currently not used. Of particular importance is the fact that the juvenile portion of the population decreased significantly from 9.0% of the rookery in 1977 to only 1.4-1.6% of the rookery population in 1985-86. For comparison, sea lion pup population rates of 22% have been observed at other Alaska rookery locations such as Marmot Island near Kodiak.

Recent counts of adult and juvenile sea lions at rookery and haul-out sites during 1989 have confirmed the continuing drastic decline in sea lion occupancy of rookery and haul-out sites in the Akutan area (Brad Smith, NMFS, personal communication). The actual count of sea lions at four key locations were as follows:

Location	Sea Lion Count
Ugamak Island rookery	450
Akun Is., Billingshead Bight rookery	150
Rootok Island haul-out	28
Akutan Island, Cape Morgan rookery	578

Possible causes for the severe drop in sea lion population include: failing reproductive rates; reduced sea survival of pups, juveniles, or adults; disease; reduction in prey food resources; entanglement with fishing nets; commercial harvests prior to 1972; and intentional killing by commercial fishermen for bait or elimination of "nuisance" animals (Merrick et al., 1987; Loughlin, no date).

The decline of sea lion numbers may be related to changes in the quantity and size of their preferred prey species. The few studies conducted on the food habits of sea lions have indicated that the primary prey are walleye pollock, *Theragra chalcogramma*, in the Bering Sea and North Pacific Ocean. This fish species is also a major prey item of harbor seals and northern fur seals. As of 1987, the biomass of pollock remained high but sporadic low abundance of age-1 pollock between 1979 and 1984 could mean that in some years there would have been fewer fish in the 10-35 cm size range. This size encompasses the mean pollock size consumed by sea lions and harbor seals (Merrick et al., 1987). Interestingly, the standard length, girth, and weight of female sea lions were smaller in the 1980s than in the 1970s, suggesting a reduced state of overall physical fitness, perhaps due to lowered nutritional levels (Loughlin, no date).

Northern sea lions were commercially harvested in the eastern Aleutian Islands between 1959 and 1972. The harvest, principally directed at young sea lions for their pelts, was halted in 1972 with the passage of the Marine Mammals Protection Act (Zimmerman, 1990).

From 1970-72, harvests of sea lion pups at Ugamak and Akutan Islands totaled 3,773 and 6,036 pups, respectively. Pup harvests, which sometimes reached 50% of the total pup production from a rookery, could have depressed recruitment to the population in the short term. However, those harvests should not have any effects on the continuing sea lion population decline because the affected populations should have stabilized 3-5 years after harvesting ceased.

Little information is available on the effects of entanglement in marine debris on sea lions. Available data suggests that entanglement is not a problem for adult sea lions. However, it is possible that entangled sea lion pups drown and are not observed (Merrick et al., 1987). Numerous sea lions have also been taken incidental to commercial fishing operations in the Bering Sea and northern Pacific Ocean since the late 1960s and early 1970s. The cumulative impact of foreign independent and joint venture fisheries in that area probably accounts for the death of 500 or less sea lions per year at present.

Merrick et al. (1987) did not speculate how the killing of sea lions by fishermen has affected the population. Fishermen have been observed to kill adult animals at rookeries, haul-outs, and in the water near boats, but the magnitude of this take is unknown. Trawl fisheries attract many sea lions during haul back operations and shooting at these animals is a common occurrence. Sea lions at sites in the eastern Aleutians also would have been prime sources of bait for crab fishermen. Thus, it may be more than a coincidence that the onset of the sea lion decline in the eastern Aleutian Islands began at the time of peak landings in the Bering Sea king crab and Tanner crab fisheries. The killing of "nuisance" animals likely still occurred until the recent designation of sea lions as a threatened species under the Endangered Species Act.

Sea Otter:

The Aleutian Islands refuge was initially established in 1913 to protect the severely depleted sea otter population. Since that time, the sea otter has made a dramatic recovery. Their population in the entire Aleutian Islands is now estimated to be between 55-73,000 animals. Colonies were established in the Fox and Krenitzin Islands during the 1960s, and these locations have the greatest potential for

population increases in the future. The population of sea otters in the Akutan area is not known since there have been no intensive efforts to survey sea otters since 1965. The location of sea otter concentration areas, established populations, and currently unpopulated habitat is shown on Map C.

Harbor Seal:

Harbor seals are found throughout the Aleutian Islands, principally in areas where water depths are less than 180 feet. They can be observed hauling-out on offshore reefs, rocks, ledges, and beaches. The number of harbor seals in the Aleutian Islands is estimated at 85,000 animals; however, the number of harbor seals present within the Krenitzin Islands area is not known. The largest haul-out concentration areas for harbor seals are located in a cluster of small islands and rock spires off the east end of Tigalda Island (Map C).

Fur Seal:

Although there are no fur seal rookeries within the Krenitzin Islands, these animals utilize Akutan Pass during seasonal movements between the Bering sea and North Pacific Ocean. Juvenile fur seals may be present year-round, and adult males wintering in the southeastern Bering Sea and northern Gulf of Alaska also forage in the Akutan area. Frequent use areas for fur seals are shown on Map C.

B.3.4 Terrestrial Mammals

Terrestrial mammals endemic to the islands of the eastern Aleutian Chain include the tundra vole and red fox. All other land mammal species were introduced, including the Norway rat, Arctic ground squirrel, Greenland collared lemming, Arctic fox, wild cattle, and rabbits. Arctic foxes are not native to any of the Aleutians. Introductions began with the Russians in 1750. Arctic and red foxes were released on at least 99 islands by 1935. They devastated breeding seabirds, waterfowl, and other birds on numerous islands, resulting in the survival of only relict numbers of certain species in some areas. For this reason, the U.S. Fish and Wildlife Service Management Plan for the Alaska Maritime National Wildlife Refuge promotes the eradication of the introduced fox from select islands to allow native bird species to return and the bird populations to recover (USFWS, 1988). The known distribution of foxes in the Krenitzin Islands is shown on Map C. Wild cattle are present on Akun Island, and domestic rabbits on Tangik and Poa Islands.

### B.3.5 Birds

The Aleutian Islands provide unique nesting habitat for several million seabirds, the endangered Aleutian Canada goose, and other waterfowl. The region also provides important migration and staging areas for a wide variety of waterfowl, shorebirds, and passerines, and provides wintering habitat for the emperor goose and other waterfowl.

#### Seabirds:

The Aleutian Islands has the largest total nesting population of seabirds in North America. The Aleutian Islands Unit of the Alaska Maritime National Wildlife Refuge is one of ~~the few refuge areas in the United States managed primarily for seabirds~~. The locations of known seabird colonies within the Krenitzin Islands are shown on Map D. Within the boundary of the Attachment Area, eighteen species of seabirds occupy thirty-four colony sites with an estimated total population of 337,083 seabirds (V. Mendenhall, 1989)<sup>1</sup>. The estimated populations by species are provided in Appendix A.

Colony locations with the greatest counts of seabirds include Avatanak Island (50,000), Derbin Island (12,490), Kaligagan Island (128,078), Tangik Island (25,810), Puffin Island (36,535), Poa Island (41,299), North Island - Akun Strait (54,166), and Kaligagan Islets #2 (16,966). Uliaga, Avatanak, and Rootok Islands are major nesting areas for puffins. Large whiskered auklet numbers occur in Avatanak Strait, and storm-petrels and other nocturnal seabirds also are abundant in the Krenitzin Islands. Detailed discussions of the status and life history events for each seabird species are available in the Alaska Maritime National Wildlife Refuge, Comprehensive Conservation Plan (USFWS, 1988).

The historic introduction of foxes to islands supporting seabird colonies significantly reduced the Aleutian Island seabird population to its current 10 million seabirds. At the present time, only 6 % of the total acreage in the Aleutian Islands is fox-free.

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<sup>1</sup>The total population of seabirds indicated for the 68 islands in the Fox Islands had approximately 1,777,000 breeding seabirds in 1980-81, when a comprehensive study was done.

Waterfowl and Waterbirds:

The lowland lakes, streams, wetlands, and adjacent marine waters of the Aleutians support important populations of nesting, feeding, and staging waterfowl. Within the Akutan area, the distribution and use areas (spring and fall concentrations, molting, winter concentrations) for ducks and geese are shown on Map D.

Raptors:

The bald eagle and Peale's peregrine falcon occur within the Aleutian Islands. Known locations of bald eagle nests are depicted on Map D. Nesting locations for peregrine falcons have not been reported in the Krenitzin Islands.

B.3.6 Endangered Species

The Aleutian Canada goose, short-tailed albatross, Chinese egret, and Aleutian shield fern are the four endangered species of animals and plants that have been observed in the Aleutian Islands. The short-tailed albatross is a rare but regular visitor to the Chain in May and August. A single Chinese egret was observed only once in the western portion of the chain. The Aleutian shield fern was historically found only on Adak and Atka, and is not known to occur in the eastern Aleutian Islands.

The Aleutian Canada goose historically nested throughout the Aleutian Islands. Following the introduction of foxes, their population had been limited to the fox-free islands of Buldir and Chagulak. Aleutian Canada geese are now being re-introduced to islands where foxes have been eradicated. As the goose population becomes established, it could expand to other areas in the Aleutian Chain which provide suitable habitat.

#### B.4 COMMERCIAL FISHERIES OF THE AKUTAN AREA

The offshore marine waters surrounding the islands of the Akutan area provide productive crab fisheries. Historically, red king crab supported a significant shellfish fishery in the eastern Aleutians region. With the currently depressed red king crab population in the area, commercial fishing for this species has been restricted.

Tanner crab harvests from the offshore waters surrounding the Krenitzin Islands support a significant seafood processing industry with four processors operating in Akutan Harbor during the 1990 tanner crab season.

A late summer commercial fishery for herring in the Fox Islands harvests approximately 3,500 tons.

Commercial fishing districts for red king crab, Tanner crab, Dungeness crab, and herring are shown on Map E. Highly productive groundfish fisheries (halibut, Pacific cod, pollock, sablefish, Atka mackerel) are located both north and south of the Krenitzin Islands area and are depicted in an inset on Map E.

Life history information for the principal bottomfish and shellfish species which occur in the vicinity of the Akutan area is available in Volume II, Resource Inventory for the Aleutians East CRSA (1984).

## B.5 SOCIO/CULTURAL DESCRIPTION OF THE AKUTAN AREA

### B.5.1 History

The modern village of Akutan was established in 1879 on a bench above the beach on the north side of Akutan Harbor. In 1979, the village was incorporated under Alaska Statutes as a second-class city and has an elected mayor and city council.

Akutan was evacuated after the Japanese attacked Dutch Harbor and occupied Attu and Kiska during World War II. The residents of Akutan were moved to Ketchikan, but permitted to return in 1944 after two years. They returned to the community in reduced numbers.

The village of Akutan was established as a fur storage and trading post by the Alaska Commercial Company in 1879. A small Norwegian-financed whaling venture was incorporated as the Alaska Whaling Company in 1912. A whaling station at Akutan Harbor produced whale oil, pet food, and fertilizer. The company continued to take approximately 100 whales per year until the beginning of World War II. In 1915, a small cod and halibut fishery was established by the resident agent of the Alaska Commercial Company. During World War II, the Navy used the Whaling Station dock as a refueling station for Russian freighters, but the facilities were abandoned soon after the war.

The close proximity of Akutan to rich crab harvesting grounds, as well as the safety, depth, and protection offered by the Akutan Harbor, led to anchoring of crab industry vessels. In the mid-1960s, Wakefield Seafood Company established an onshore business by constructing a docking facility on land it leased from the Russian Orthodox Church at the traditional village site. Using the leased land as a processing site, Wakefield Seafood Company employed local villagers.

With growth of the regional fishing industry in the late 1970s and overcrowding of available facilities at Dutch Harbor to the west, Akutan Harbor witnessed use by increasing numbers of seafood processing vessels. This industrial growth resulted in expansion of Seawest Industries, Incorporated, facilities with the construction of a warehouse and an onshore bunkhouse for its workers. Trident Seafoods became involved in the bottomfish industry to take advantage of the rich fishing grounds in the

Bering Sea from a protected onshore base at Akutan Harbor. To implement the venture, Trident established a large processing plant one-half mile west of the community. Community growth has been spurred by the construction of 16 new housing units in 1982 by the Aleutian Housing Authority (Norgaard Consultants, 1984).

#### B.5.2 Historical and Archaeological Resources

The eastern Aleutian Islands encompassed by the Akutan area have numerous historical and archaeological sites associated with early Aleut presence in the region, historical religious buildings, and historical contact with non-Aleut traders. Recognized areas of historical and ~~archaeological~~ importance in the Krenitzin Islands Area have been identified by the Aleutians East Borough, and file information describing the important features present at these locations is maintained in the offices of the Aleutians East Borough and by the State Historic Preservation Officer in the Department of Natural Resources

#### B.5.3 Community Demographics and Economy

Despite changing economic conditions, Akutan, the only community in the Krenitzin Islands, has maintained a relatively stable population since its establishment. In 1888, there were 59 people in the village. The population increased to 66 in 1920, 86 in 1950, and 169 in 1980 (including some temporary workers from seafood processing ships). The population of Akutan for the fiscal year 1990 State Revenue Sharing Program was 432 persons (Alaska Department of Community and Regional Affairs, 1990).

With the exception of a sulfur mine and smelter which operated on Akun Island at the turn of the century, the economy of the Akutan region has historically been dependent on fisheries, particularly the seafood processing industry. In the 1960s and 1970s, king crab dominated the fishing industry in the Akutan area. During the 1979-80 season more than 132 million pounds of king crab were harvested from the Bering Sea. Historically, as many as 14 floating seafood processor ships have anchored in the Akutan Harbor each year to process crab and bottomfish.

Akutan Harbor is one of only a few well-protected harbors in the Aleutian chain, and it would likely be the base for any future economic expansion in the Akutan addition

area. Trident Seafoods has modernized and expanded their shore-based seafood processing facilities in Akutan. Transportation to Akutan is limited to boats and amphibious aircraft. The community does not have an upland runway for wheeled planes. Air access is extremely dependent on weather, and conditions can isolate the community for weeks at a time. Winter hazards to shipping are presented by high waves, occasional shorefast ice, and rare pack ice. There are no roads or motor vehicles on Akutan Island; the boardwalk system is the main thoroughfare for the community.

#### B.5.4 Land Ownership and Management:

Under the Alaska Native Claims Settlement Act (1971), the Akutan Village Corporation selected all unpatented lands on the island of Akutan, plus some lands on the neighboring island of Akun. The City of Akutan received 1285 acres as part of the reconveyance process. The ~~Aleut Corporation~~ generally owns the subsurface rights under land held by the village corporation, including geothermal resources. Land ownership patterns within the Akutan addition area are shown on Map G.

The natural features of Akutan Harbor, including its depth, protection from high winds by surrounding topography, and available supply of fresh water have facilitated growth and expansion which has utilized most of the acreage suitable for development. Future land use and community expansion will be influenced by the land use patterns. The major land owners in the community are the Akutan Village Corporation, the State of Alaska, the Russian Orthodox Church, the Aleut Corporation, and major private holdings owned or leased to fishing industry interests.

#### B.5.5 Subsistence Harvest of Fish and Wildlife:

The harvest of subsistence resources within the Krenitzin Islands is geographically limited by the distance residents can travel from Akutan, the only community. Although the level of community participation in subsistence activities was reduced after re-occupation of Akutan after World War II, the collection of subsistence resources is still an important component of the economy for residents who utilize coastal resources of the area. Subsistence resources harvested include herring, salmon (sockeye, pink, and coho), eider and seabird eggs, sea urchins, and clams. The locations in which subsistence activities occur are concentrated along the northeast side of Akutan Harbor, the Baby Islands, and along the west and south side of Akun Island. Subsistence harvest sites for the Akutan area are shown on Map H.

## B.6 SUPPLEMENTAL RESOURCE ANALYSIS FOR THE AKUTAN AREA

For the Akutan area, principal concerns associated with potential impacts to coastal resources and uses are related to:

- o seafood processing activities in Akutan Harbor
- o the recent declaration of "threatened" status for sea lions under the Marine Mammal Protection Act
- o interference with subsistence harvest activities
- o potential oil and gas exploration in the St. George Basin, or shipment of petroleum by tankers through Unimak Pass
- o industrial expansion and community facility construction in Akutan Harbor and the City of Akutan

The remote nature of much of the lands and waters of the Krenitzin Islands, and the low potential for offshore oil and gas development or resource extraction activities in the foreseeable future reduces the likelihood of direct impact to coastal resources and uses from these activities. The commercial fishing and seafood processing industry, and expansion of these activities in the Akutan area, are issues of interest and concern to the community of Akutan and the Aleutians East Borough coastal management program.

The discussions of development activities and impact descriptions presented in Volume II, An Analysis of Potential Development and Environmental Sensitivity in the Aleutians East CRSA (July 1985), are applicable to coastal resources, potential impacts, and coastal resource uses and activities in the Akutan area.

The City of Akutan has been involved in a number of planning studies to chart the community's future and to address recognized problems related to transportation, fuel storage, solid waste disposal, development at the head of Akutan Bay, and public dock and harbor facilities. Pertinent reports which describe those planning activities and feasibility studies for community improvement are listed below:

- o Akutan - Prospects for Development (Department of Community and Regional Affairs, 1983)

## Aleutians East Borough Coastal Management Program

- o Akutan Transportation Study - A Review of Transportation Issues and Recommendations for the City of Akutan (Darbyshire and Associates, 1983)
- o Development Plan - Bulk Fuel Storage Facility, Seaplane Ramp, and Public Dock (Norgaard Consultants, 1984)
- o Akutan Port Study - A Report for the City of Akutan (Peratrovich and Nottingham, Inc., 1981)
- o City of Akutan - 1982 Comprehensive Plan
- o Bottomfish Harbor Study: Akutan, Alaska (U.S. Fish and Wildlife Service, 1983)

The following sections provide an overview of some resource issues and potential development activities in the Krenitzin Islands.

### Management of Federal Lands:

As land manager for Alaska Maritime National Wildlife Refuge lands in the Krenitzin Islands, the U.S. Fish and Wildlife Service has a significant level of control over the use and protection of coastal resources on refuge lands (see Map G). The Fish and Wildlife Service has identified the following potential problems affecting fish, wildlife, and habitats on Maritime Refuge lands (USFWS, 1988):

- o depletion of forage fish by commercial fisheries
- o net mortality to seabirds and marine mammals
- o introduced predators
- o marine mammal management
- o grazing and trespass problems
- o lack of detailed resource data
- o subsistence monitoring

The management approach for the U.S. Fish and Wildlife Service is described in detail in the Alaska Maritime National Wildlife Refuge Comprehensive Conservation Plan (1988).

### Hydropower Development Investigations:

In 1980, Ott Water Engineers prepared a preliminary design report on the potential for using hydropower to supplement the electrical power needs of the community of

Akutan. The stream basin evaluated for hydropower potential is located approximately one mile northwest of the City of Akutan. The drainage basin is situated between 500 and 1,600 feet above sea level and has an area of 0.5 square miles. The initial evaluation collected preliminary data on rainfall and streamflow, soils, seismic characteristics of the area, and considered options for locations of a dam and hydropower generation equipment. The report recommended that additional design work and studies be completed before final cost estimates could be determined.

During 1990, the Alaska Energy Authority completed updated studies for the Akutan Hydroelectric Project which estimated construction costs at \$1.6 million.

**Bulk Fuel Facility, Seaplane Ramp, and Public Dock:**

Norgaard Consultants (1984) prepared a reconnaissance and planning assessment report to provide comprehensive siting criteria for engineering design of a bulk fuel storage facility, seaplane ramp, and improved public dock for the City of Akutan.

The development area is located near Salt House Cove, west of the Seawest Industries dock and warehouse. As proposed, the seaplane ramp will be 25 feet wide with a 100-foot by 60-foot turnaround pad, sufficient to accommodate two amphibious aircraft.

Two storage tanks for diesel fuel (30,000 gallons each) and one for gasoline (5,000 gallons) are to be located on the uplands above the seaplane ramp. The storage tanks would be filled from a receiving location on the Seawest Dock. Construction of 16 new houses and a diesel generator power plant had dramatically increased Akutan's fuel consumption. Lack of adequate storage facilities had necessitated frequent purchases of fuel in uneconomical small volumes.

Current plans call for a public dock to be constructed west of the seaplane ramp in October, 1990. The dock will be owned and operated by the City of Akutan. The uplands at this location provide a favorable site to support onshore development compatible with existing and proposed land uses.

The City of Akutan also wishes to pursue development of a harbor facility within Akutan Harbor to accommodate fishing boats associated with the expanding bottomfish industry. In 1983, the U.S. Fish and Wildlife Service prepared a bottomfish harbor study for the U.S. Army Corps of Engineers to evaluate potential harbor sites.

Of the harbor locations considered, the City of Akutan is most supportive of the Salthouse Cove site.

Geothermal Power Development:

Any significant geothermal development would have to take into consideration the natural hazards which exist on the Island of Akutan. Since the community of Akutan is located in a high risk seismic zone, any development would have to be designed to withstand the effects of seismic events.

Due to recurring activity of Akutan Volcano, geothermal development projects should also consider the risks associated with volcanic activity. Most of the recent eruptions of Akutan Volcano have involved only ash and steam, although some lava flows have occurred on the north side of the island.

Slope stability and the potential for liquefaction of soils in the Hot Springs Bay area will have a significant effect on the design and construction of any geothermal power facilities in this location (Morris-Knudsen, 1981).

Threatened Species Status of Sea Lions:

Due to the precipitous decline in the population of sea lions in Alaska, and particularly in the eastern Aleutian Islands, on April 5, 1990, the National Marine Fisheries Service adopted an emergency regulation that designates the Steller sea lion as a "threatened" species under the Endangered Species Act (NMFS, 1990). Listing the sea lion as threatened means that the population of animals are in very serious difficulty. It also indicates that the Commercial Fisheries Exemption previously applied to the incidental take of sea lions will not be in effect, and that commercial fishing operations will be restricted if the National Marine Fisheries Service deems it necessary to protect sea lions, pursuant to the Endangered Species Act (Tremaine, 1990).

The emergency regulation prohibits shooting at or near any sea lion in U.S. waters, except for native subsistence. It also prohibits boats from coming within three miles of certain sea lion rookeries and empowers the Secretary of Commerce to place observers on any fishing vessel in order to monitor the accidental capture of sea lions in fishing gear. In addition, the regulation restricts the number of sea lions which may be accidentally caught and killed during fishing operations west of 141 degrees west

longitude to 675 animals. Sea lion rookeries in the Akutan area which are specifically identified for protective measures in the NMFS emergency regulation include:

- o Ugamak Island (east end of island)
- o Akun Island (Billings Head Bight)
- o Akutan Island (southwest corner, Cape Morgan)

The complete text and rookery location information for the National Marine Fisheries Service Notice to All Commercial Fishermen - Sea Lion Alert dated April 9, 1990, is provided in Appendix B. An Emergency Rule published by U.S. Fish and Wildlife Service on April 10, 1990, also prohibited any person from approaching closer than 1/2 mile on land or within sight of any of the designated sea lion rookeries. Special conditions for Navigational Transit of boats through certain straits, narrows, and passageways has been identified by the U.S. Fish and Wildlife Service to minimize disturbance to important sea lion rookery sites. Within the Akutan area, navigational restrictions apply as follows:

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Rookery Location	Minimum Proximity Strait, Narrows, or Pass	from Rookery *
Ugamak Island	Ugamak Strait between Ugamak Island and Tigalda Island	1.0 n.m.
Akutan Island	Akutan Pass between Cape Morgan and Unalga Island	1.0 n.m.

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\* n.m. = nautical mile

The designation of sea lions as a threatened species, and the Emergency Regulations (NMFS) and Emergency Rule (USFWS) are intended to address a critical concern about the welfare of sea lion populations and important rookery and haul-out use areas. Within the Akutan addition area of the Aleutians East Borough coastal management program, these rules will provide an important aspect of protection for the sea lion and affect potential uses and activities of other coastal resources in the identified areas of concern.

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**ATTACHMENT 2: POPULATION BY SPECIES OF SEABIRDS FOR ALL COLONIES WITHIN THE KRENITZIN ISLANDS**

Seabird Species	Estimated Population
Fork-tailed storm-petrel	19236
Leach's storm-petrel	7740
Double-crested cormorant	468
Pelagic cormorant	249
Red-faced cormorant	5779
Common eider	10
Black oystercatcher	96
Glaucous-winged gull	5994
Black-legged kittiwake	346
Common murre	1280
Thick-billed murre	220
Pigeon guillemot	1394
Ancient murrelet	3550
Cassin's auklet	450
Whiskered auklet	95
Horned puffin	745
Tufted puffin	<u>289431</u>
TOTAL	337083

Source: V. Mendenhall, 1989